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(54) Improved stencil or mask for applying solder to circuit boards

(57) A one-piece metal screen having a stencil or mask region (12) comprising one or more apertures and/or fine lines extending through the screen, includes at least a portion (13) of the remainder of the screen which has material removed therefrom. This serves to relieve or compensate for uneven stress in the screen during printing. The material may be removed by etching or laser cutting, and serves to reduce the thickness of the portion (13).

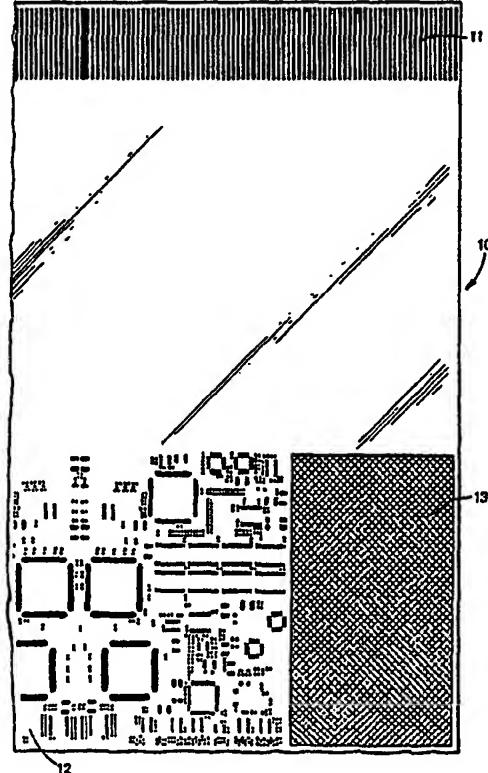


FIG. 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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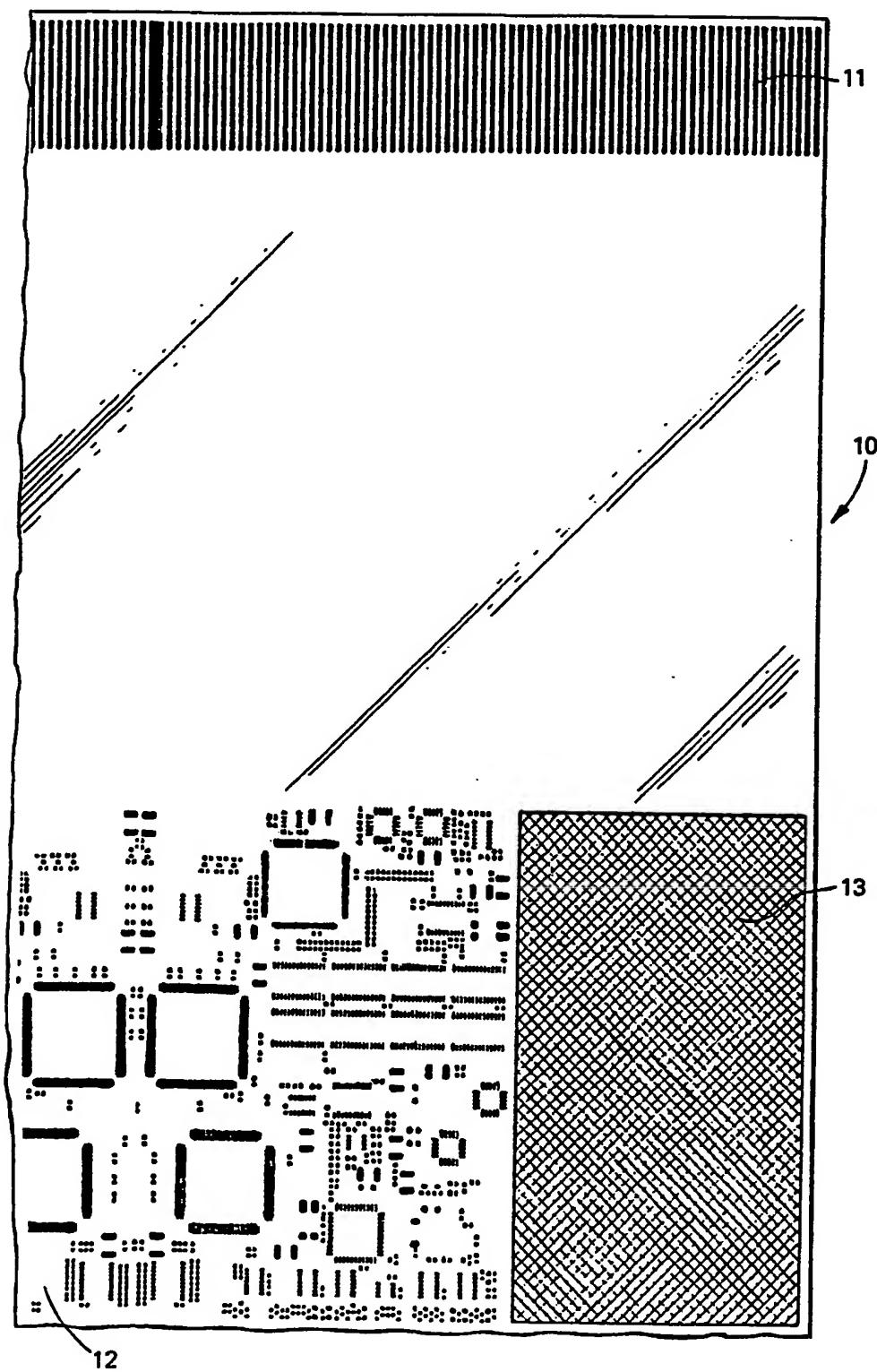


FIG. 1

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***IMPROVED STENCIL OR MASK FOR APPLYING SOLDER
TO CIRCUIT BOARDS***

The present invention relates to an improved stencil or mask arrangement for use in the application of solder paste onto electric/electronic circuit boards.

It is known to produce circuit boards with solder connections for components, such as integrated circuit chips, by applying a solder paste to the circuit board by a screen or stencil printing process. In one such known printing process, a solder stencil or mask comprises a thin sheet of stainless steel or brass or like material, in which fine lines or apertures extending through the sheet for the passage of solder paste have been formed, for example by etching or laser cutting. Such one-piece metal screen including said stencil or mask is normally held in a tensioned manner in a rigid rectangular supporting and printing frame.

In use, such frame and screen arrangement is located above a supply of circuit boards which are passed thereunder. As each board passes thereunder, the solder paste is applied to the normally upper surface of the screen by a "squeegee" and solder paste passes through the apertures and fine lines provided in the stencil or mask of the screen on to the circuit board.

In order to ensure that solder paste only passes through the desired apertures and fine lines provided in the stencil, the screen utilised must extend across the whole length and width of the supporting frame.

The metal screens utilised are very thin and have a thickness of the order of 100-200 microns. Once the desired stencil has been provided in the screen, for example by etching or laser cutting, the screen is

located in the supporting frame which is generally tensioned in the longitudinal direction, by means of appropriate attachment means to the screen at its top and bottom. However, in many instances, particularly due to the fact that there is a concentration of apertures in one particular area of the screen, there appears to be a distortion such as a bubbling or "oil can effect" in the surface of the screen in the region of such etched or cut portion.

Such distortion in the area or region in which etching or cutting has taken place, has previously been attributed to the fact that the metal screen is not flat, and that due to the very thin nature of such metal screens, it is not possible for a rolling company to produce a totally flat screen.

It is the intention of the user to have a metal screen which is absolutely flat whereby good contact with the circuit board on which it is applied is achieved.

It is believed that the reason why the distortion occurs in the surface of the screen in the area or region in which the apertured and fine line portions have been provided is due to the fact that the even stress pattern which is induced in the rolling process when the metal sheet is rolled flat has been disturbed.

It is an object of the present invention to provide an improved stencil or mask arrangement of a metal screen which remains substantially flat in use.

According to the present invention there is provided an improved one-piece metal screen, said screen having a stencil or mask comprising one or more apertures and/or fine lines extending through a portion of said screen, usually a central portion thereof, wherein at least a portion of the remainder of the screen of height corresponding to that of the stencil or mask and extending across the width of the screen in the region of the stencil or mask and on the normally lower surface of the screen, or non-squeegeed surface, has material removed therefrom.

Preferably, material is removed from the majority of the remainder of the non-stencil or non-mask portion extending across the width of the screen and being of substantially the same height as the stencil or mask and in the region of the stencil or mask, and in effect reduces the thickness of such remaining portion.

In effect, a band is produced across the screen which is of the same height as the stencil or mask portion and, in the non-stencil or non-mask region, material is removed from the normally lower surface of the screen to effectively reduce the thickness of the screen in said width band.

The removal of material must not extend through the metal screen in the non-stencil or non-mask region, since it is imperative that solder paste does not pass through the screen, except in the stencil or mask region.

The removal of material, which effectively

reduces the thickness of the width band referred to above results in the disturbance of the stress pattern induced in the material in the rolling process being overcome and, when such screen is tensioned in the support frame, the width band referred to above remains substantially flat.

Removal of material can be effected by provision of narrow etched lines, suitably in criss cross formation, and the material is suitably removed by etching or by laser cutting, or by any other suitable procedure. It is, of course, possible to utilise other type of patterns to remove material from the non-stencil or non-mask portion in the width band referred to above.

The present invention will be further illustrated, by way of example, with reference to the accompanying informal drawing, in which Fig. 1 illustrates top right hand corner portion of a metal screen in plan view looking down on to the normally lower surface of said screen. The portion of the screen 10 illustrated is attached to a support frame, not shown, at its top by means of engaging members 11.

A portion of the stencil or mask 12 is provided in the approximate central portion of the screen. In the width band corresponding to the height of the stencil or mask 12, in the region in which the stencil or mask does not extend, material is removed from portion 13 so as to equalise the stress pattern throughout such width band. The corresponding portion of the left hand side of the screen 10, corresponding in height to the stencil or mask portion, is of the sam

form as that of portion 13. As indicated, a cross hatching arrangement of narrow lines is utilised to effectively enable material to be removed by etching or other means so as to effectively reduce the thickness of portion 13.

It is imperative that the removal of material does not extend through to the normally upper surface of the screen and the provision of the narrow line pattern ensures that such will not take place, whilst at the same time enabling appropriate material to be removed.

When such treated screen is located in its supporting frame and appropriately tensioned, then the width band of the screen comprising the stencil or mask portion 12 and the reduced thickness portions 13 remain substantially flat. When the solder paste is applied to the normally upper surface of the screen, suitably by a squeegee, solder paste passes through the apertures and fine lines provided in the stencil or mask of the screen to the circuit board, and since in the width band concerned the screen is kept substantially flat, correct transfer of solder paste to the circuit board takes place.

It can be seen that other alternative types of patterns or arrangements can be produced to ensure that appropriate material is removed from the width band region of the screen so as to ensure that the stencil or mask portion is maintained in a very flat or substantially flat condition in use.

It is to be understood that the costs involved

in producing the reduced thickness portion by removal of material by etching or like means is of an extremely minor nature when compared to the costs of producing the stencil or mask.

CLAIMS

1. A metal screen having a stencil or mask portion comprising one or more apertures and/or fine lines extending through the screen, and at least a portion of the remainder of the screen having material removed therefrom to relieve or compensate for any uneven stress patterns or deformations.
2. A one-piece metal screen having a stencil or mask region comprising one or more apertures and/or fine lines extending through the screen, wherein at least a portion of the remainder of the screen of height corresponding to that of the stencil or mask and extending across the width of the screen in the region of the stencil or mask and on the normally lower surface of the screen, or non-squeegeed surface, has material removed therefrom.
3. A screen as claimed in claim 1 or 2, in which material is removed from the majority of the remainder of the non-stencil or non-mask portion extending across the width of the screen and being of substantially the same height as the stencil or mask and in the region of the stencil or mask, and in effect reduces the thickness of such remaining portion.
4. A screen as claimed in any of claims 1 to 3, in which a band is produced across the screen which is of the same height as the stencil or mask portion and, in the non-stencil or non-mask region, material is removed from the normally lower surface of the screen to effectively reduce the thickness of the screen in said width band.

5. A screen as claimed in any of claims 2 to 4 in which the removal of material does not extend through the metal screen in the non-stencil or non-mask region, so that solder paste does not pass through the screen other than in the stencil or mask region.

6. A screen as claimed in any of claims 1 to 5, in which the removal of material is such as to at least reduce the thickness of the width band referred to above so as to result in the disturbance of the stress pattern induced in the material in the rolling process being overcome and, when such screen is tensioned in the support frame, the width band referred to above remains substantially flat.

7. A screen as claimed in any of claims 1 to 6, in which removal of material is effected by provision of narrow etched lines, suitably in criss cross or other pattern formation or other arrangements, and the material is removed by etching or by laser cutting, or by any other procedure.

8. A screen substantially as herein described with reference to the accompanying drawings.

Amendments to the claims have been filed as follows

1. A screen comprising a stencil or mask region having one or more apertures extending through the screen, and at least a portion of the remainder of the screen having material removed therefrom to form at least one recess to relieve or compensate for any uneven stress.
2. A one-piece metal screen comprising a rectangular sheet having apertures at opposite end regions defining engaging portions to permit attachment to a support frame, a stencil or mask region having one or more apertures extending through the screen, and at least one recessed portion formed by having material removed from the sheet in at least a portion of the screen.
3. A screen as claimed in claim 2, in which the recessed portion extends across the width of the screen.
4. A screen as claimed in claim 3, in which the recessed portion extends laterally of the stencil or mask portion.
5. A screen as claimed in any of claims 1 to 4, in which the recessed portion is on the normally lower surface or "non-squeegeed" surface of the screen.
6. A screen as claimed in any of claims 1 to 5, in which material is removed from the majority of the remainder of the non-stencil or non-mask portion extending across the width of the screen and being of substantially the same height as the stencil or mask and

in the region of the stencil or mask, and in effect reduces the thickness of such remaining portion to form a or said at least one recessed portion.

7. A screen as claimed in claim , in which material is removed from the majority of the remainder of the non-stencil or non-mask portion.

8. A screen as claimed in any of claims 1 to 7, in which a band of recesses is produced across the screen which is of the same height as the stencil or mask portion and, in the non-stencil or non-mask region, and produced by material being removed from the normally lower surface of the screen to effectively reduce the thickness of the screen in said width band without forming apertures through the sheet.

9. A screen as claimed in any of claims 1 to 8, in which the removal of material to form recesses is such as to reduce the thickness of the sheet so as to result in the disturbance of the stress pattern being overcome such that, when the screen is tensioned in a support frame, the operative portion of the screen remains substantially flat.

10. A screen as claimed in any of claims 1 to 6, in which removal of material is effected by provision of narrow etched lines, suitably in criss cross or other pattern formation or other arrangements.

11. A screen as claimed in any of claims 1 to 10, in which the material is removed by etching or by laser cutting or by any other procedure.

12. A one-piece metal screen having a stencil or mask region comprising one or more apertures and/or fine lines extending through the screen, wherein at least a portion of the remainder of the screen of height corresponding to that of the stencil or mask and extending across the width of the screen in the region of the stencil or mask and on the normally lower surface of the screen, or non-squeegeed surface, has material removed therefrom.

13. A screen substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
 Examiner's report to the Comptroller under Section 17
 (The Search report)

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Relevant Technical Fields		Search Examiner A DAVEY
(i) UK Cl (Ed.M)	B6C: CHB, CHD, CJX, CKW H1R: RAF	Date of completion of Search 19 MAY 1994
(ii) Int Cl (Ed.5)	B41F: 15/00, 15/34, 15/36, 15/38 B41C: 1/14 B41N: 1/24	Documents considered relevant following a search in respect of Claims :- 1-8
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASE: WPI		

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2264460 A	(WILLIAMS) note eg. Figure 1 and page 3	1,2,5,6
X	GB 1321743 A	(DU PONT) whole document	1

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